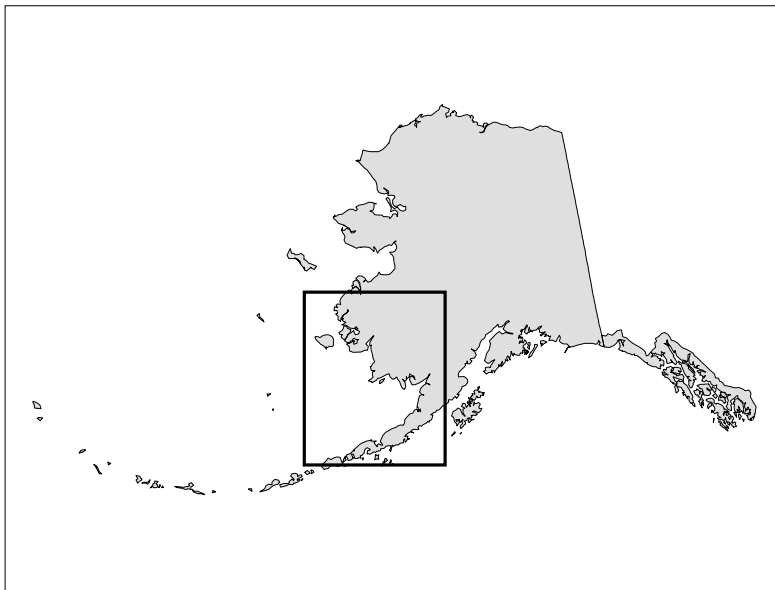


STELLER'S EIDER SPRING MIGRATION SURVEYS
SOUTHWEST ALASKA
2001



by:
William W. Larned

U.S. Fish and Wildlife Service
Migratory Bird Management Office
Waterfowl Branch - Anchorage, Alaska
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William W. Larned

*U.S. Fish and Wildlife Service, Waterfowl Management,
43655 KBeach Rd., Soldotna, Alaska 99669.*

Abstract. Annual spring aerial surveys were initiated in 1992, and repeated in 1993, 1994, 1997, 1998, 2000, and 2001, to assess and monitor the population status of Steller's eiders (*Polysticta stelleri*) migrating northward in southwestern Alaska. Since the timing of migration varies, two to three replicate shoreline surveys were conducted each spring through 1997, to increase the probability of encountering the entire population of eiders as they transited the survey area en route to their arctic breeding grounds. Fiscal constraints in 1998 and 2000 permitted only one annual survey, the timing of which was carefully scheduled using satellite sea ice imagery and other pertinent data. Two replicates were planned in 2001, but periods of inclement weather limited us to a single survey, which we conducted 22 April to 1 May. We made visual estimates of Steller's eiders and all other identifiable water birds and marine mammals. The highest Steller's eider count for each year was used as that year's estimate of the prebreeding population. Peak estimates, uncorrected for observer bias, were 137,904 in 1992; 88,636 in 1993; 107,589 in 1994; 90,269 in 1997, 84,459 in 1998, 72,953 in 2000, and 60,656 in 2001. In 2000 and 2001 large continuous habitats within the survey area were sampled using a systematic grid of known-width transects, and the data were expanded accordingly. The unexpanded 2001 total, which is more comparable to data from earlier years, is 58,231. Using this figure, survey data indicate a 7.2% annual decline in migrating Steller's eiders ($R^2 = 0.806$), which we feel supports continuing the survey. In 1998 we used counts from aerial photographs of 17 flocks to adjust the estimate for observer bias. In 2000 and 2001, our aerial photo sample was inadequate for such adjustment. We classified observed Steller's eiders into hatching-year (all-brown birds in flocks consisting mostly of brown birds) and after-hatching-year birds (all others), as a crude measure of recruitment. By this method we found 12,922 juveniles, or 15.3 percent of total observed, in 1998, none at all in 2000, and 4553 subadults, or 8 percent of total observed, in 2001. Patterns of habitat use by Steller's eiders and most other sea duck species during migration was similar among years, indicating numerous important spring habitats. Maps show survey route and distribution of Steller's eiders within the survey area in 2001. Detailed distributional data are available for all observed species upon request.

Key Words: Steller's eider, *Polysticta stelleri*, king eider, *Somateria spectabilis*, migration, population, Aerial, survey, waterfowl, water birds, Bering Sea, Bristol Bay

INTRODUCTION

The majority of the world population of Steller's eiders migrates along the Bristol Bay coast of the Alaska Peninsula in the spring, crosses Bristol Bay toward Cape Pierce, then continues northward along the Bering Sea coast. Most then cross the Bering Strait to their breeding grounds in Siberia, with a smaller number continuing north to the Alaska north slope to breed (Gill et al. 1978). They linger en route to feed at the mouths of lagoons and other productive habitats. From 1981 to present, migrating Steller's eiders were estimated during spring aerial surveys of emperor geese conducted over coastal habitats from Cape Romanzof to and including both the north and south coasts of the Alaska Peninsula. Results of this effort indicate a decline in prebreeding Steller's eider populations during this period, but some of the large between-year fluctuations may be artifacts of survey timing, and a goose-oriented technique that is not optimal for eiders. Concern over apparent declines of eiders prompted the U.S. Fish and Wildlife Service to initiate surveys in 1992 to monitor the population of Steller's eiders that winters in Alaska waters. Since a comprehensive survey of the species is not currently feasible on its extensive and remote winter range, which includes the Aleutian islands, the Alaska Peninsula, and the western Gulf of Alaska including Kodiak and lower Cook Inlet, current surveys estimate their numbers as they stage during migration in Bristol Bay and the Yukon-Kuskokwim Delta. Objectives of the effort are:

1. Obtain an annual estimate of the prebreeding population of Steller's eiders that winter in Alaskan waters.
2. Document distribution of and habitats used by Steller's eiders during migration.
3. Provide additional information on Steller's eiders, such as indications of annual recruitment.
4. Describe populations and distributions of other migrating water birds and marine mammals, to the extent that doing so does not compromise the Steller's eider objectives.

This report summarizes results and observations from the 2000 Steller's eider survey, with comparisons to earlier surveys.

STUDY AREA AND METHODS

The survey area included sea duck habitats along the coast of southwestern Alaska from Cape Romanzof on the Yukon-Kuskokwim Delta (Y-K Delta) to Chignik Bay on the south side of the Alaska Peninsula. Steller's eiders are shallow feeders normally found close to shore and in shoals in lagoons, bays and occasionally offshore areas. The primary example of the latter is the extensive shoal area of Kuskokwim Bay, where Steller's eiders congregate primarily within about 20 km of the shoreline south of Kipnuk, but extending as scattered small flocks from there to the shoreline north of Goodnews Bay. Our objective for coverage was to search adaptively to observe all Steller's eiders within the survey area, and most important concentrations of other sea ducks. We flew a Cessna 206 amphibious airplane over near-shore waters at an airspeed of 90 to 100 kts (166 to 185 km/hr) and an altitude of 150 to 250 feet (46 to 76 m). Habitats within Lagoons and bays were covered using an adaptive contiguous search pattern, while exposed shorelines were surveyed using a single track parallel to the coast within 1 km of the shoreline. The effort required for comparable coverage among surveys varied somewhat, depending

upon the aggregate of sightability factors, such as lighting, sea surface condition, and bird distribution. For the Kuskokwim Bay area, we felt we accomplished essentially complete coverage of the dense concentrations of Steller's eiders south of Kipnuk, while for the portion of the bay from the Kipnuk shoals to the shoreline north of Goodnews Bay we sampled using a "sawtooth" flight pattern. We also used this technique in some other offshore areas which contained few or no Steller's eiders but large numbers of other sea ducks (Figs. 1 and 2). For analysis, these areas were treated the same as the rest of the survey area before 2000, but in 2000 and 2001 we extrapolated within these areas using expansion factors calculated as: km^2 of survey area / (linear km of flight lines within the survey area * km transect width). This method renders population indices that account for portions of the survey area that are incompletely covered, but are not comparable to results before 2000, particularly for black scoters, white-winged scoters, long-tailed ducks, king eiders and Steller's eiders. For this reason we provide a table with unextrapolated data for comparison with historic data (Table 2).

For geographical reference, the shoreline was historically divided into 126 numbered segments (Larned et al. 1994), most identical to those used for the annual spring emperor goose survey conducted by the U.S. Fish and Wildlife Service, Fairbanks. However, in 1997 we began using a global positioning system (GPS)/laptop computer data collection system which enabled us to electronically record our flight path and the precise location of each observation, so the segments were no longer used. This system, consisting of a laptop computer for each observer, connected by serial cable to the onboard GPS receiver, enabled observers to record observations directly into the laptops. A custom program developed by John Hodges (U.S. Fish and Wildlife Service, Migratory Bird Management, Juneau, AK) recorded our flight path and automatically linked GPS coordinates to each recorded observation. Later transcription, using another special program written by Hodges, produced ASCII data files wherein each line contained a species and number observation plus geographic coordinates, date, and time. We also recorded ancillary data, including tide stage (high, medium, low, unknown), ice cover in tenths, and sea condition (calm, light chop, medium chop to occasional whitecaps, heavy chop with prevalent whitecaps). These data are included in separate fields within each line in the output file.

In some years we repeated the survey up to three times each year to bracket the spring migration period, using the highest count as that year's Steller's eider estimate. In 1998, 2000, and 2001 only one survey per year was flown. We intended to conduct 2 complete surveys in 2001, but cancelled the first of these due to an extended period of inclement weather. The Steller's eider total is considered a minimal population estimate because some birds may escape detection by the survey crew by moving northward during the periods between survey flights, while others may be outside the survey area (north or south) during the survey. While we strive diligently to minimize such errors, we have no way of detecting or measuring shifts that may occur during the survey.

Our recorded flight path for the survey of 22 April to 1 May 2001, which is typical, is displayed in Figs. 1-4. Please note that, due to interspecific differences in timing of migration and habitat preferences, the coverage described above is not adequate for a complete census of other species within the survey area. Accordingly numeric results for these species are highly variable among years. General interpretive comments by species are included in the RESULTS section of the 1998 Steller's eider survey report (Larned 1998).

Table 1. Total flight hours for spring Steller's eider surveys, southwest Alaska, 1992-00.

Survey No.	1992	1993	1994	1997	1998	2000	2001
1	39.1	35.8	40.2	36.4	35.5	36.9	41.8
2	32.1	40.4	25.0	34.4			
3	31.3	34.3					

In most years of this survey we observed flocks in Alaska Peninsula lagoons consisting mostly of light-brown Steller's eiders, usually with relatively small numbers of birds with adult-male-looking plumage. Chris Dau (Migratory Bird Management, Anchorage), who has conducted occasional late spring surveys in lower Alaska Peninsula lagoons, stated that it is typical in late-May and early June to have Steller's eider flocks in these areas with all or nearly all brown-plumaged birds, often with a few adult-plumaged males mixed in. We suspect that the latter may be second-year or possibly third-year birds not yet breeding. The majority of other flocks we see during the survey have a fairly even sex ratio, with males and females homogeneously dispersed within each flock. Most females in these flocks are very dark, with a distinct speculum, bordered by faint white bars that are usually visible in flight. Although Dau (pers. comm.) suggests that females usually do not attain this dark adult plumage until the Alternate II molt, we feel it is reasonable to assume that most of the brown birds in the late-migrating (or non-migrating) predominately brown flocks are hatching-year birds (based on the very small numbers of adult-plumaged males present, and our assumption that the proportion of after-hatching-year females not yet breeding would not be higher than that of males). We have recorded and totaled estimates of the brown bird components of these flocks, and provide the results as a crude index to annual recruitment. We have not attempted to determine the relative contributions of the Russian vs. Alaskan breeding grounds to the total recruitment estimate.

We photographed some of the Steller's eider flocks in 1998, 2000, and 2001 to increase the precision of the survey. In 1998 a population estimate was made based on eiders counted in the photographed flocks plus flock estimates of unphotographed flocks adjusted using a comparison of photo counts and visual estimates of photographed flocks (Larned 1998). In 2000 and 2001 we did not obtain enough good quality photographs to permit this analysis. Obtaining photos of entire flocks of Steller's eiders is challenging because they dive frequently and often sequentially. One ends up with a lot of images with unknown portions of flocks visible, which are not useful for this process.

The aerial survey crew since the beginning of the survey in 1992 has consisted of Bill Larned as pilot and port observer, with various starboard observers. In an effort to minimize the effects of observer bias, only experienced aerial observers were used, the pilot intentionally maneuvered the aircraft so that the majority of larger eider flocks were on his side for estimation, and observers received training in flock estimation, using a computer simulation program (Wildlife Counts by John Hodges, USFWS, Juneau, AK). Paul Anderson functioned as starboard observer in 2000.

RESULTS AND CONCLUSIONS

Habitat and survey conditions

Unlike the previous winter, the winter of 2000-2001 was very mild, with continuous sea ice not developing in the Bering Sea south of latitude 65 degrees North until late February (Russell Page, National Weather Service pers. comm.). By mid-April there was much open water along the Y-K Delta coast and through the Bering Strait, which is earlier than usual for an open travel lane for migrating eiders. Unfortunately the first of our planned surveys, set to begin on 16 April, was cancelled due to a prolonged period of inclement weather. This may have provided an opportunity for some Steller's eiders to move north out of the survey area before we commenced the survey, while normally they are late migrants that linger in Bristol Bay and YK Delta coastal habitats until late April or early May before proceeding northward.

Survey conditions were good for most of the area, with light winds and calm seas allowing us to survey offshore safely. However, we were not able to survey on 23, 29 and 30 April due to strong winds and snow showers.

Itinerary for 2001 survey

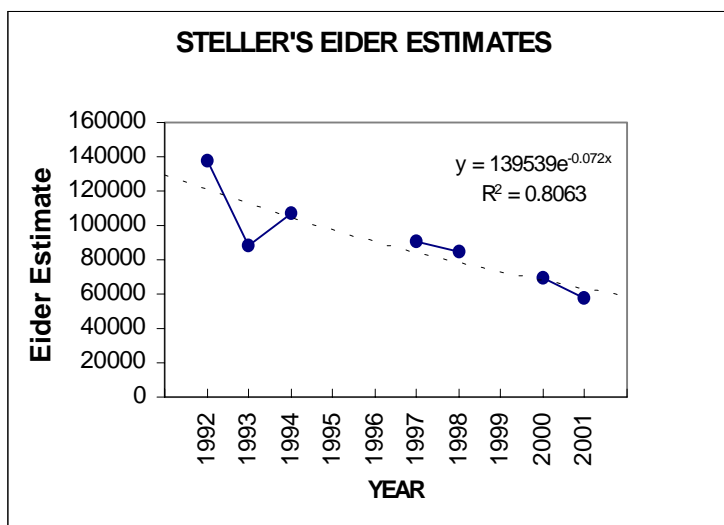
- 4/16 Attempted to depart from Anchorage to Bethel, but mechanical aircraft discrepancies grounded the flight.
- 4/17 Completed aircraft repairs, flew to Bethel, and overnighted at the refuge Bethel bunkhouse.
- 4/18 Surveyed YK Delta coast, Nunivak Island and Toksook Bay to Kuskokwim River mouth, then stayed at the Bethel bunkhouse.
- 4/19 Cancelled surveys due to high winds on the coast.
- 4/20 The survey crew returned to Anchorage via commercial air due to a forecasted prolonged period of bad weather.
- 4/22 The crew returned to Bethel via commercial air, then flew surveys from the Kuskokwim River mouth to Kipnuk.
- 4/23 Cancelled the survey flight due to poor weather on the coast.
- 4/24 Surveyed Nunivak Island
- 4/25 Surveyed Scammon Bay to Kipnuk
- 4/26 Surveyed Kuskokwim River to King Salmon
- 4/27 Surveyed King Salmon to Seal Islands Lagoon, then ran into dense fog along the coast, and flew inland directly to Cold Bay. Stayed overnight at Izembek Refuge bunkhouse.
- 4/28 Surveyed Izembek NWR and local lagoons. Stayed overnight at Izembek Refuge bunkhouse.
- 4/29,30 Grounded due to high winds, low visibility, and rain. Stayed overnight at Izembek Refuge bunkhouse.
- 5/1 Surveyed Nelson Lagoon and Port Moller, flew to King Salmon and spent the night at the Refuge bunkhouse.
- 5/2 Flew directly back to Anchorage. End of survey.

Steller's eider results

The 2001 unadjusted Steller's eider estimate of 58,231 (adjusted figure using numbers extrapolated from sampled portions of the survey area: 60,656) continued a downward trend (-7.2 percent as of 2001) since the survey's inception in 1992 (Table 2 and graph below). As in 2000 (Larned 2000), we suspect

that survey results may have been biased low, again due to survey timing. This time we think a portion of the breeding population may have moved northward out of the survey area. I emphasize this is a conjecture based on the late timing of the survey relative to the unusually early dispersal of sea ice along the Alaska Bering Sea coast. We should not dismiss the possibility that a real decline is occurring.

In 1998, we classified 12,922 birds, or 15.3 percent of the Steller's eiders observed, as hatching-year birds (Larned 1998). In 2000, we observed no flocks containing a predominance of brown-plumaged birds, suggesting minimal recruitment for the 1999 breeding season. In 2001, we recorded 4,553, or 8 percent of the total 58,231 Steller's eiders observed, as hatching-year. Most of these birds were in flocks consisting mostly of brown-plumaged birds, but also containing several birds that had plumage characteristics of adult males (white wings and heads). The above figures do not include the adult-looking birds within these flocks.



The distribution of Steller's eiders within the survey area this year (Figure 5) is normal for a survey conducted late in the migration period: adults were concentrated in more northern habitats, while most of the juvenile-plumaged birds were in the lagoons of the western portion of the Alaska Peninsula. The pattern of habitat use by concentrations of eiders was similar to that seen during previous years' surveys.

King eider

We apparently surveyed this year after the main pulse of king eiders migrated northward out of the survey area, as the total number estimated was 23,302 (adjusted estimate 58,128), compared with 211,988(219,403) estimated in 2000 (Tables 1, 2). In our experience during this annual survey, most king eider flocks are very homogenous: either breeding adult or juvenile/subadult, based on plumage characteristics. In mid-April of 1997 we encountered 42,254 mostly hatching-year birds in large dense flocks along the Alaska Peninsula. In 2000 we recorded only 350 obviously hatching-year king eiders, while in 2001 we tallied 14,678 individuals of this age cohort. In our opinion this provides a relative index to recruitment from the previous year as in the case of Steller's eiders, though it may also be affected by the timing of the survey, as an unknown portion of the non-breeding component may delay arrival to the Alaska Peninsula lagoons, or not arrive at all.

Other sea ducks

Estimates of common eiders, long-tailed ducks, and scoters were all smaller than those of 2000, probably owing to phenologically-late survey timing, as these species are known to be early migrants.

Table 1 lists 2001 results for sea ducks, brant and emperor geese by geographic area, with expanded estimates for the four sampled areas. Table 2 lists survey totals for all surveys and all species conducted

since 1992. Figures for 2001 are unexpanded in Table 2 to facilitate comparison among years, so will not necessarily agree with those in Table 1.

RECOMMENDATIONS

1. As of 2001 this survey indicates a 7.2% annual decline in the Alaska prebreeding population of Steller's eiders. Conceding the questionable precision of the survey, we nonetheless feel that, in light of the widespread concern for and listed status of this species, it would be negligent not to continue this or some other comprehensive population monitoring effort. If this survey is to be continued, it is important to return to a flexible design prescribing up to 3 replicates per year, because the only reliable measure of proper survey timing is the observed eider distribution from the survey itself (i.e. the distributional results of the first survey in a given year should be used to determine the necessity for and scheduling of additional survey(s) that year).

2. Several major questions relating to interpretation of the age-ratio observations remain unanswered: Do all, or most of, hatching-year birds remain in the wintering area after the adults have migrated? How about older non-breeders? What proportion, if any, of non-breeders accompany breeding adults to the breeding grounds? What is the distribution of non-breeders after adult migration? Are there pockets of non-breeding flocks that remain in other parts of the wintering range beyond the Alaska Peninsula? Are these patterns constant or do they vary from year to year depending on winter habitat conditions and other variables?

The presence of non-breeding flocks during and after the survey in Alaska Peninsula habitats may provide an opportunity to monitor some population parameters like annual recruitment. We need to decide whether or not this information is useful to the management of the species, considering that we may not be able to determine breeding-ground or even continental origin of this recruitment. If we decide it is useful, we should try to address some of the above questions. For instance, it would be useful to know if the population of birds in the "brown-bird" flocks remains constant or changes between late April and late May. If these birds gradually filter in to Alaska Peninsula lagoons through this period, then perhaps a late May survey would be the best way to monitor this portion of the population. However, if most of these birds normally arrive early enough to be adequately surveyed in conjunction with the migration survey in mid-to-late April, then there may not be a need to conduct a separate survey at a later time. A test survey late next May to compare with April results might begin to answer that question.

ACKNOWLEDGMENTS

I gratefully acknowledge the assistance of the managers and staffs of Alaska Peninsula/Becharof, Izembek, and Yukon Delta National Wildlife Refuges, who provided for the logistic needs of crew and aircraft. I also sincerely appreciate the help of starboard observer Paul Anderson, who performed his task competently and enthusiastically.

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Table 1. Seaduck and goose estimates for geographic aerial survey units, spring Steller's eider survey, southwest Alaska, April & May 2001.

Survey Unit	Date surveyed	Elapsed Time	Expansion Factor	Steller's eider	King eider	Common eider	Long-tailed duck	Harlequin duck	Black scoter	White-winged scoter	Surf scoter	Black brant	Emperor goose
Scammon Bay to Toksook Bay ¹	4/25	3:09	7.43		186	1,939	4,295						
Nunivak Island	4/24	1:31		1,664	465	50	335		5				
Toksook Bay to Kuskokwim R.	4/22,25	3:05		9,918	85	2,465	1,710		63	110			
Kuskokwim R. to Security Cove ¹	4/26	2:28	5.24	2,883	2,919	582	1,305		686	3,191			
Goodnews Bay	4/26	0:22		1,698			188		23	11			
Chagvan Bay	4/26	0:15		2,451	230		17		2	2		7,216	5
Nanvak Bay	4/26	0:05		110								1,200	60
Nanvak Bay to Togiak Village	4/26	0:40		16		17	13		4	11			
Togiak Vilage to Kulukak Bay	4/26	0:15		25			3	47		6			
Kulukak Bay to Cape Constantine ¹	4/26	0:35	3.82		19		374		115	554			
Cape Constantine ¹	4/26	0:22	3.63	127	4,927	36	7		18	25			
Kvichak Bay ¹	4/26	1:30	5.96		34,508		7,378		16,116	54			
Naknek River to Port Heiden	4/27	1:19		1	6	13	382	12	635	49			
Egegik Bay	4/27	0:17		431	65	18	435		1,553	60			841
Ugashik Bay	4/27	0:28			50		692		4,724	220			108
Cinder River Sanctuary	4/27	0:15		603	30	20	6		1,580	50			6,658
Port Heiden	4/27	0:48		7,875	6,630	20	185		1,408	25			14,374
Port Heiden to Moffet Bay	04/27, 5/1	1:34		244	703		593	227	1,551		4	129	12
Seal Islands Lagoon	4/27	0:16		2,905		150	80		2				7,854
Port Moller	5/1	0:37		2,741	3,980		531		3,786	15			1,724
Nelson Lagoon	5/1	0:40		1,787	3,265	445	294		721	2		30	7,526
Izembek Lagoon	4/28	1:47		24,096		1	14	14	100	8		64,547	2,638
Kinzerof Lagoon	4/28	0:06		480					8			435	
Morzhovoi Bay Lagoons	4/28	0:09		40								170	
Hook Bay	4/28	0:10						75	220			1,110	
Catherine's Cove	4/28	0:16		376	20			15	54		3		
Other areas				185	40	23	111	556	212	6	10		
Totals				60,656	58,128	5,779	18,948	946	33,586	4,399	17	74,837	41,800

1. Estimates reported for these survey units were expanded using a factor calculated as: area of survey unit/(length of transect x transect width). Survey areas extrapolated to are illustrated in figures 1-3.

Table 2. Survey totals for all species, Spring Steller's eider surveys, southwest Alaska, 1992 to 2001. For consistency with data prior to 2000, this table contains only unexpanded estimates from sampled areas.

Species	4/9-13/92	4/23-27/92	5/2-6/92	4/6-9/93	4/25-27/93	5/3-8/93	4/15/94	4/24-5/1/94	5/6-12/94	4/15-19/97	4/26-30/97	4/22-29/98	4/17-23/00	4/22-5/1/01	average ⁷
Red-necked grebe			32		793	16		112	221	178	85	29	114	316	240
Horned grebe									3				2		3
Common loon		3	5	13	8			8	13	8	8				10
Yellow-billed loon			2												2
Pacific loon			2	30	28	30		23	34	2	45	23	5	3	20
Red-throated loon			78	2	51	38		22	270	9	11	97	61	188	108
Unident. loon								85	13	7		24	3	137	51
Pigeon guillemot								1	8	2		50	2	60	24
Unident. murre 1			985	56,183		2,041		2,204	1,419	42,544	13,745	28,334	1,839	119	18,887
Arctic tern			53			249		48	836		3			87	246
Mew gull			3,419	944	934	3,872		2,141	1,608	3,482	1,006	6,699	2,741	2,018	3,482
Black-legged kittiwake			68,888	616	26,579	11,380		1,032	6,614	41,957	33,301	28,333	2,624	479	25,068
Sabine's gull						166		173	26			10			116
Large gull 2		5,035	18,072	22,480	27,525	49,378	1,307	13,847	24,865	27,738	17,018	25,769	7,991	9,249	23,295
Jaeger						4		5	2			1	1		3
Cormorant 3		803	979	831	767	1,082	6	1,618	441	829	432	653	335	674	881
Common merganser										10	2	2	6		5
Red-breasted merganser	1,030	2,103	1,352	1,176	435	549		1,901	2,766	660	364	1,393	208	211	1,217
Mallard			88	27	20	24		39	18	93	107	2	97	15	54
American wigeon			4					8			2	79	2		19
Am. Green-winged teal								75	4		2	1			26
Gadwall			5			2			15			10	2		7
Northern shoveler			28			2		3	14			3		4	10
Northern pintail			5,325	160	1,782	1,792		1,760	717	624	1,414	893	857	618	1,808
Canvasback						3		57				2			21
Scaup 4	2,245	6,970	11,106	2,113	2,719	5,316		2,467	6,598	1,544	3,072	2,289	1,864	1,188	4,490
Goldeneye	151	588	711	177	46			263	6	365	197	136	319	181	307
Bufflehead	33	36	25	66	2	2		400	3				2		126
Long-tailed duck	4,501	20,512	11,982	12,829	6,396	13,184	16,033	22,987	11,194	25,548	19,815	22,025	11,569	7,756	17,654
Harlequin duck		757	245	608	231	56		192	838	328	119	243	373	946	585
Steller's eider	64,408	109,645	137,904	88,636	77,198	76,857	1,150	85,730	107,589	90,269	87,993	84,459	68,956	58,231	90,863
Spectacled eider		40	5		4	26		35		1	20	16		4	24
Common eider	678	4,291	5,941	3,036	2,729	5,069	2,747	6,997	1,447	3,800	21,916	3,862	2,925	3,604	7,188
King eider	13,203	34,672	87,954	62,544	25,945	10,054	1,926	69,638	25,886	241,992	57,215	71,438	211,988	23,302	109,837
Unident. scoter		361									1,474	136			657
Black scoter	18,766	25,273	42,382	22,038	23,463	37,985		27,131	35,672	31,750	24,869	45,312	19,931	19,521	33,222
White-winged scoter	281	1,331	501	432	309	254		185	484	914	2,080	2,520	2,696	1,345	1,555
Surf scoter		10	23	347				46	48	359	100	8	17	17	117
White-fronted goose					51	430		26	30	80	2	54		94	138
Canada goose			169	6	28	4		34	6	13	57	210	26	97	89
Black Brant		168	5,289	9,798	31,670	81,743		29,566	71,551	38,608	80,099	34,045	58,212	74,851	57,970
Emperor goose	19	27,876		21,278	21,158	28,542		20,985	25,816	41,279	37,976	53,926	32,562	41,816	35,974
Tundra swan		2	2		4	9		2	2	24		46		7	15
Sandhill crane		4	2			21		10	6			2			9
Small shorebird 5								3,066	9,737	40,540	14,930	9,997	13,990	456	14,944
Large shorebird 6								47				15			31
Bald eagle			24	78	36	27		29	27	23	16	22	17	24	31
common raven								1		3	9	5			5
Sea otter		12	1,736	981	865	650		791	809	1,272	1,554	1,068	809	523	1,069
Pacific walrus		150	229	30	303	315		108	1,030	55	143	136	110	1	281
Seal		2	588	1,106	1,190	1,976	3	601	2,130	621	1,156	620	438	1,617	1,218
Steller's sea lion			314	20	398	902		566	833	408	934	1,033	42	8	581
Harbor porpoise			17	9	8	6			5	8	4	1	12		9
Belukha whale		80			10				67	100	9		62		64
Orca whale			1						6	1					4
Grey whale		6	92	26	64	114		94	36	47	102	57	37	14	73

1. Mostly common murre, may include thick-billed. 2. Lumped due to observer inconsistencies. Includes mainly glaucous, glaucous-winged, and occasional herring gulls.

3. Lumped due to observer inconsistencies. Includes pelagic, red-faced and double-crested. 4. Mainly greater scaup.

5. Incl. plovers, lesser yellowlegs, all sandpipers, phalaropes, dowitchers, common snipe, turnstones, surfbird, dunlin and others

6. Incl. godwits, whimbrel, Bristle-thighed curlew, greater yellowlegs and others. 7. Mean of highest annual estimates.



Figure 1. Survey units and flight lines, Steller's eider spring migration survey, southwest Alaska, April 2001.

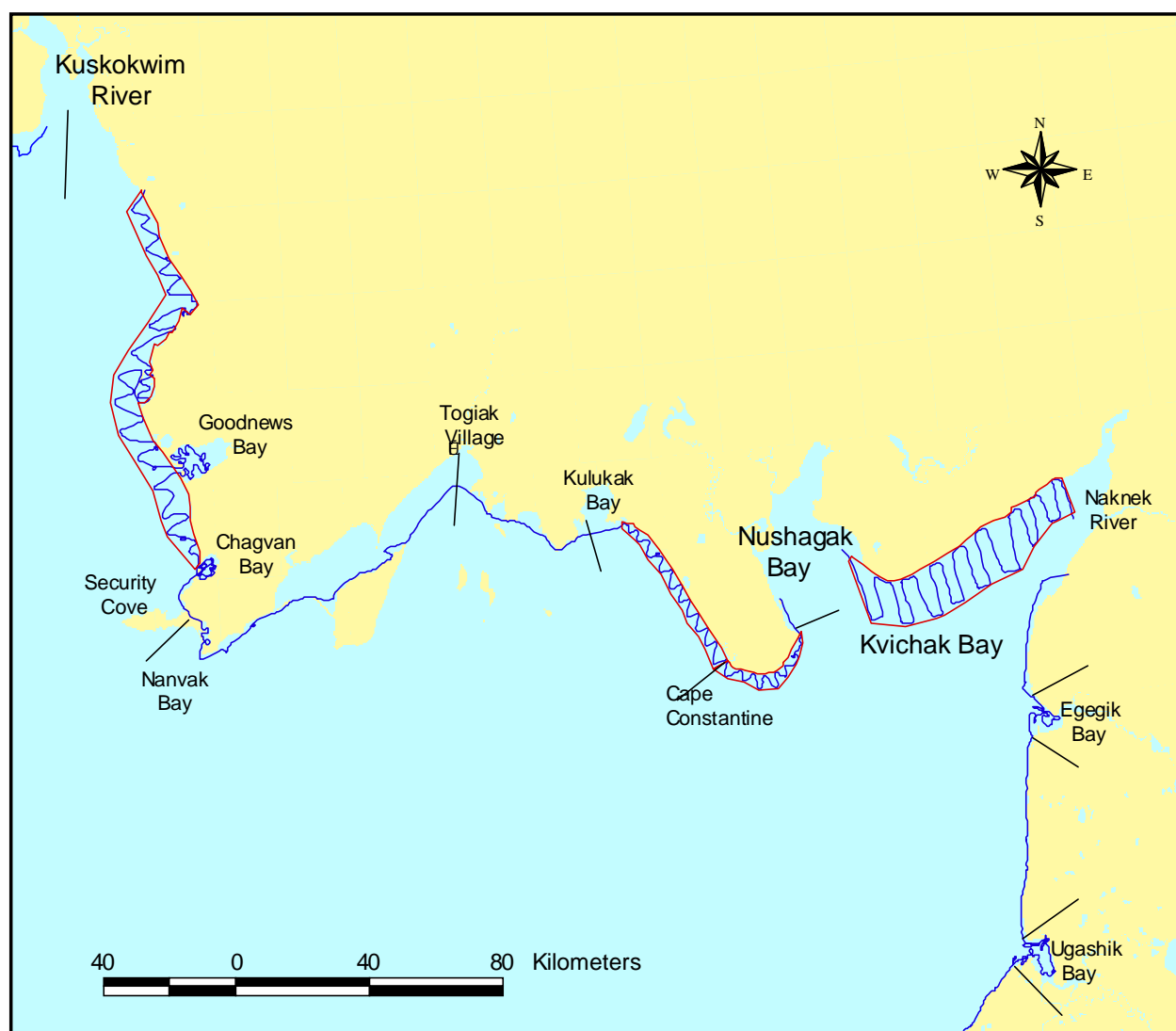


Figure 2. Survey units and flight lines, Steller's eider spring migration survey, southwest Alaska, April 2001.

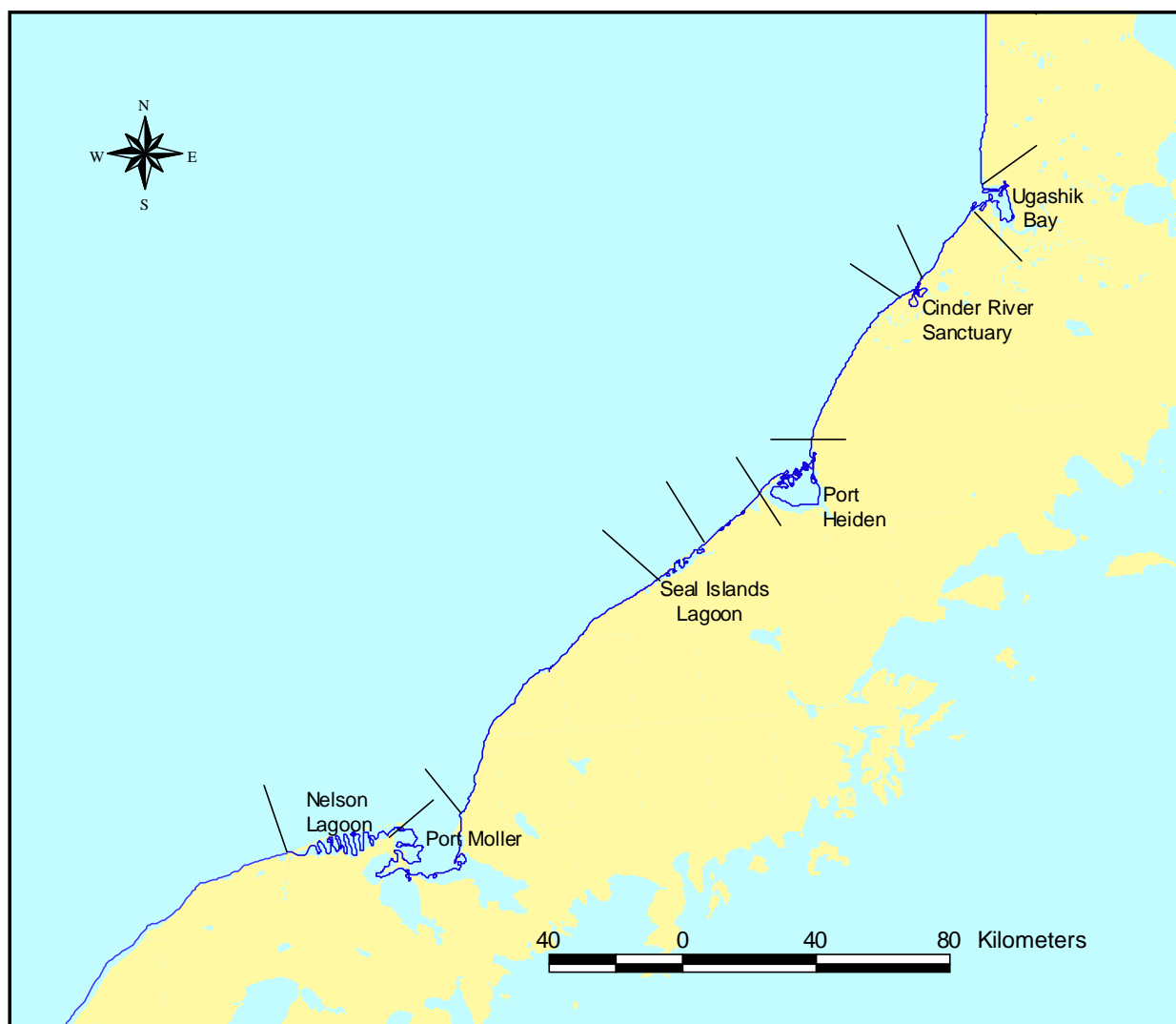


Figure 3. Survey units and flight lines, Steller's eider spring migration survey, southwest Alaska, April and May, 2001.

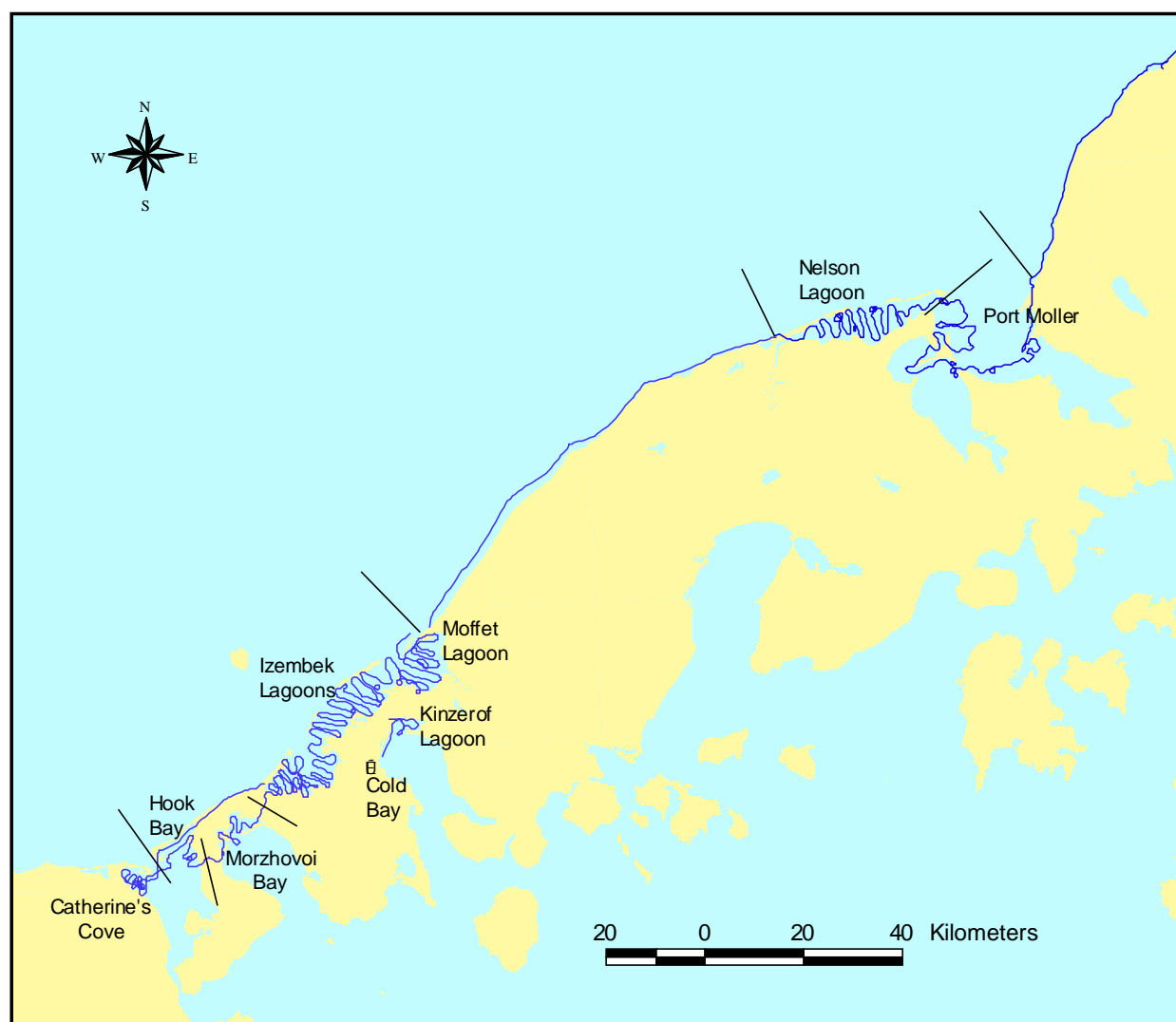


Figure 4. Survey units and flight lines, Steller's eider spring migration survey, southwest Alaska, April and May, 2001.

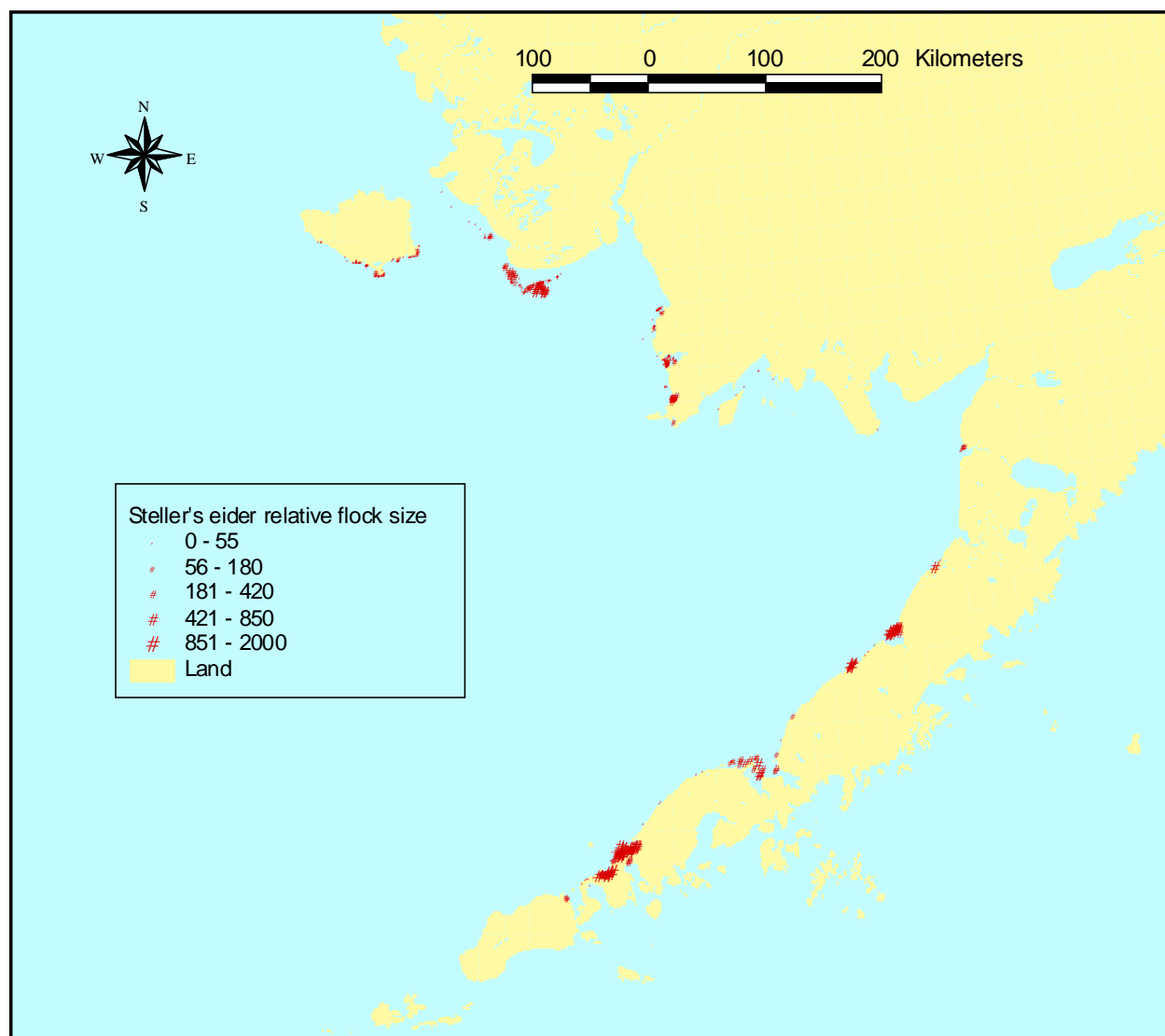


Figure 5. Location and relative sizes of Steller's eider flocks observed during the Steller's eider spring migration survey, southwest Alaska, April and May, 2001.

APPENDIX 1. Common and scientific names of species mentioned in the text and tables.

Common Name	Scientific Name
<u>Birds:</u>	
Red-necked grebe	<i>Podiceps grisegena</i>
Horned grebe	<i>Podiceps auritus</i>
Common loon	<i>Gavia immer</i>
Yellow-billed loon	<i>Gavia adamsii</i>
Pacific loon	<i>Gavia pacifica</i>
Red-throated loon	<i>Gavia stellata</i>
Pigeon guillemot	<i>Cephus columba</i>
Unidentified murre	<i>Uria aalge</i> , <i>U. lomvia</i>
Arctic tern	<i>Sterna paradisaea</i>
Mew gull	<i>Larus canus</i>
Sabine's gull	<i>Xema sabini</i>
Black-legged kittiwake	<i>Rissa tridactyla</i>
Large gull	<i>Larus glaucescens</i> , <i>L. hyperboreus</i> , <i>L. argentatus</i> , <i>L. schistisagus</i>
Jaegers	<i>Stercorarius parasiticus</i> , <i>S. longicaudus</i>
Cormorant	<i>Phalacrocorax auritus</i> , <i>P. pelagicus</i> , <i>P. urile</i>
Common merganser	<i>Mergus merganser</i>
Red-breasted merganser	<i>Mergus serrator</i>
Mallard	<i>Anas platyrhynchos</i>
Gadwall	<i>Anas strepera</i>
American wigeon	<i>Anas americana</i>
Green-winged teal	<i>Anas crecca</i>
Northern shoveler	<i>Anas clypeata</i>
Northern pintail	<i>Anas acuta</i>
Canvasback	<i>Aythya valisineria</i>
Scaup	<i>Aythya marila</i> , <i>A. affinis</i>
Goldeneye	<i>Bucephala clangula</i> , <i>B. islandica</i>
Bufflehead	<i>Bucephala albeola</i>
Harlequin duck	<i>Histrionicus histrionicus</i>
Oldsquaw	<i>Clangula hyemalis</i>
Spectacled eider	<i>Somateria fischeri</i>
Common eider	<i>Somateria mollissima</i>
King eider	<i>Somateria spectabilis</i>
Steller's eider	<i>Polysticta stelleri</i>
Black scoter	<i>Melanitta nigra</i>
White-winged scoter	<i>Melanitta fusca</i>
Surf scoter	<i>Melanitta perspicillata</i>
Canada goose	<i>Branta canadensis</i>
Black brant	<i>Branta bernicla</i>
White-fronted goose	<i>Anser albifrons</i>
Emperor goose	<i>Chen canagica</i>
Tundra swan	<i>Cygnus columbianus</i>
Sandhill crane	<i>Grus canadensis</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>
Common raven	<i>Corvus corax</i>

Marine mammals:

Sea otter	<i>Enhydra lutris</i>
Pacific walrus	<i>Odobenus rosmarus</i>
Seal	<i>Phoca spp., esp. Phoca vitulina</i>
Steller's sea lion	<i>Eumetopias jubatus</i>
Harbor porpoise	<i>Phocoena phocoena</i>
Belukha whale	<i>Delphinapterus leucas</i>
Orca whale	<i>Orcinus orca</i>
Gray whale	<i>Eschrichtius robustus</i>
